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Update of bycatch in the Estuary and Gulf of St. Lawrence Northern shrimp fishery in 2012

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

In the Gulf of St. Lawrence, the only type of authorized northern shrimp fishing is a commercial fishing practised with a trawl for which the minimal mesh size is 40 mm. Although large individuals are released from the trawl through the mandatory use of a separator grate, a certain number of small specimens remain in the catches. This report documents the composition and size of bycatches in the Gulf shrimp fishery in 2012.

SOMMAIRE

Dans le golfe du Saint-Laurent, le seul type de pêche à la crevette nordique autorisé est une pêche commerciale pratiquée à l'aide d'un chalut de fond dont la grandeur minimale des mailles est de 40 mm. Bien que les gros individus soient libérés du chalut grâce à l'utilisation d'une grille séparatrice, il demeure toujours une certaine quantité de petits spécimens dans les prises. Ce rapport documente la composition et l'ampleur des prises accessoires dans la pêche à la crevette du golfe en 2012.

INTRODUCTION

In the Gulf of St. Lawrence, the only type of authorized northern shrimp (*Pandalus borealis*) fishing is commercial fishing practiced with a trawl. Since 1986, a minimum mesh size of 40 mm has been in force to minimize catches of small shrimp and more closely target the size of shrimp caught to market demand. The sorting grate use became mandatory for all fishers in the winter of 1993 in order to greatly reduce accidental groundfish catches. The sorting system must be inserted into the trawl lengthening piece. It includes a funnel or guiding panel, a rectangular sorting grid with a vertical rod spacing ranging from a minimum of 19 mm to a maximum of 25 mm and a triangular orifice on top of the lengthening piece that must be left completely open in order to facilitate the escape of fish from the trawl.

Although large individuals have been released from the trawl through the mandatory use of a sorting grid, a certain number of small specimens remain in the catches. The DFO *Policy Framework on Managing Bycatch and Discards* (currently under development) aims to ensure that Canadian fisheries are managed in a manner that supports the sustainable harvesting of aquatic species by 1) Minimizing the risk of fisheries causing serious or irreversible harm to bycatch and discard species, and 2) Accounting for total catch, including bycatch and discards.

This report documents the composition and size of bycatches in the Gulf shrimp fishery in 2012.

INPUT DATA

The study area corresponds to the four shrimp fishing areas in the Estuary and northern Gulf of St. Lawrence (Figure 1). The commercial fishery has developed almost exclusively in 4R and 4S NAFO Divisions and in the unit areas 4Tp, 4Tq, 4To, 4Tn, 4Tk, and 4Tf (Figure 2). In general, shrimp fishing is carried out in the Esquiman and Anticosti channels and along the two Laurentian Channel slopes up to the Estuary (Savard 2012). Traditional fishing grounds are located at depths between 200 and 300 m.

AT-SEA OBERVER DATA

Harvesters are obliged to have an at-sea observer on board at the Department's request. The At-Sea Observer Program aims at 5% coverage of all shrimper fishing trips. These observers record detailed information on tows (position, duration, catch per species or taxa and, for some species, specimen length). Data from the At-Sea Observer Program that were used for this study were collected in 2012 during the northern shrimp fishing in the Estuary and Gulf of St. Lawrence.

A validation of the fishing tows was done to eliminate missing or unlikely data for the fishing tow duration. The duration is calculated from the time at the beginning and at the end of a tow. No value in 2012 was above the 15 hour threshold that was determined from a preceding study (Savard et al. 2013). In 2012, 1,190 fishing tows are available after data validation (6 tows for which the positions are improbable were not considered in the analyses). They represent a total effort of 5,193 hours that were allocated to NAFO unit and shrimp fishing areas (Table 1).

In 2012, organisms that were identified on vessels by observers were recorded under 142 different names. These data were aggregated into 69 taxa (Savard et al. 2013). The observers

record the weight of catches with a precision of 1 kg. The 1 kg precision is probably sufficient for the large catches but could be a problem when the catch of a species is made up of one or few specimens. A mean weight for the first weight class was estimated from the tow frequency distribution by weight class (Savard et al. 2013). The model allows the prediction of the mean weight of the first class that was used in the estimate of bycatch for 41 taxa in 2012.

SHRIMPER FISHING EFFORT

License holders for shrimp fishing are required to document their trawling operations in a logbook. The information recorded for each day at sea includes estimated shrimp catch, number of trawling hours and fishing site.

The fishing effort was compiled by NAFO unit area in 2012 and 2011 data were updated with the last version of the catch and effort shrimper file. Cumulative effort does not encompass all fishing activities, since it was necessary to disregard a number of observations because they were erroneous or incomplete (Savard 2012). However, the total fishing effort was estimated using official landings and estimated catch per unit effort (cpue) based on the subset of confirmed observations (effort = landing x $cpue^{-1}$). The fishing effort in each unit area was adjusted on a pro rata basis in relation to the annual total fishing effort (Table 1).

WEIGHTING CELLS

To extrapolate the results of the observer sampling to the total fishing effort of the entire shrimp fleet, the at-sea observer samples and the fishing effort data were combined by NAFO unit area and shrimp fishing area (Table 1). Cells with little fishing effort and little sampling from observers were combined with adjacent unit areas belonging to a same shrimp fishing area (Table 1). A weighting factor ($\sum$ shrimper effort/$\sum$observer effort) was calculated and used to extrapolate the bycatch results to the entire fleet.

RESULTS AND DISCUSSION

Figure 3 shows that shrimp fishing tows realized with an observer in 2012 correspond to the most exploited fishing grounds.

In 2012, the ratio of all bycatches in weight compared to northern shrimp catches was 1.72%. The vast majority (93%) of bycatches was not retained, while only 0.1% of the northern chrimp catches was discarded. The target species (northern shrimp) was caught in 99.8% of all fishing tows carried out in the presence of an observer.

In 2012, sixteen taxa out of the 69 examined were present in 10% or more of the tows while 23 taxa were observed in less than 1% of the fishing tows (Table 2). Apart from northern shrimp, the ten most common species are capelin, Greenland halibut, Atlantic herring, American plaice, redfish, barracudina, witch flounder, thorny skate, Atlantic cod and hagfish. The ten species with the largest catches (in weight) after northern shrimp are capelin, Atlantic herring, Greenland halibut, American plaice, black dogfish, Atlantic cod, witch flounder, barracudina, redfish and Atlantic halibut.

Bycatches (in weight) were estimated for 29 taxa by NAFO unit area and shrimp fishing area from 2000 to 2012 (Table 3). The taxa that are presented, are the followings:

- Groundfishes: Atlantic cod, white hake, silver hake, redfishes, longfin hake, lumpfish;
- Flatfishes: Greenland halibut, Atlantic halibut, American plaice, witch flounder;
- Pelagic fishes: capelin, Atlantic herring, Atlantic mackerel, sand lances, barracudina;
- Skates: thorny skate, smooth skate, winter skate;
- Wolffishes: Atlantic wolffish, spotted wolffish, northern wolffish;
- Other fishes: hagfish, black dogfish, striped bass
- Invertebrates: striped shrimp, white shrimp, snow crab, sea pens, sponges.

Length frequencies are available for Greenland halibut, redfishes, American plaice, witch flounder, Atlantic cod and Atlantic halibut (Figure 4). Redfish species were grouped under same taxa because it is not possible for the observers to differentiate the species apart on board a vessel. Bycatch in number could be estimated from these data for these species except for Atlantic halibut, because the number of specimens that were measured is too low (Table 4).

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Table 1. Observer fishing effort (hours), shrimper fishing effort (hours) and weighting factor by cell (combination of shrimp fishing areas (SFA) and NAFO unit areas) used to extrapolate the at-sea observer results to the total fishing effort of the shrimper fleet.

OBSERVERS

SFA	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8
NAFO	4Tp	4Tq	4To	4Tn	4Tk	4Tg	4Sz	4Si	4Sy	4Ss	4Tf	4Tk	4Ss	4Sx	4Sy	4Sv	4Sv	4Ra	4Rb	4Rc	4R
2000		11	956	207	44	85	387	405		1471		331	1035	522	12	36	3	65	782		
2001		68	803	132	46	136	503	572		862		2	650	837		19	12	42	863	11	
2002		71	355	34	18	230	943	382		527	17	464	1095	693	61	130	52	119	920	11	
2003		12	555	26	24	34	701	256		1072		5	993	361	46	11	92		613	10	337
2004		29	480			114	691	343		1488		44	803	851			27		308	25	162
2005		96	44	188	115	189	1058	87		960		195	754	382					233		202
2006		57	739	144	60	95	866	497		622		15	818	423		27	71	8	278	118	244
2007		138	420	135	33	169	546	701		292		15	319	1491			16	8	338	11	526
2008		153	298	103	22	177	831	456		501		3	75	1565	40	12	7		495	5	152
2009		181	262	113	213	111	629	541		439		18	33	2135	111	56			228		84
2010		172	311	47	13	191	1068	801	4	622			6	1966	65	20	22		627	12	147
2011	22	541	101	10	176	81	527	593		578			99	1855	199	121			433		252
2012		266	313	338	302	87	614	201		537	11	34	31	1219	39	130	36		645	39	352

SHRIMPERS

SFA	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8
NAFO	4Tp	4Tq	4To	4Tn	4Tk	4Tg	4Sz	4Si	4Sy	4Ss	4Tf	4Tk	4Ss	4Sx	4Sy	4Sv	4Sv	4Ra	4Rb	4Rc	4R
2000		2051	16464	1791	389	33	10413	7281		15730	200	3840	16150	20206	1688	494		3556	21557		
2001		3292	21677	1288	324	255	14130	10563		19150		166	9983	19431	494	2111	279	2908	23999	28	
2002		3615	5084	332	146		10205	19287	16	22567		2828	18415	18882	1002	498	997	3309	24621	305	
2003		1935	8345	278	61	76	8600	5103		15823	5	410	22087	10264	285	265	315	498	19381	188	
2004		2614	11308	20	369	42	16664	2794		20857	5	1293	19428	19375	611	287	56	1351	17531	28	
2005		2458	4183	440	322	74	13705	1839		20853	23	311	17133	7476	194	32	438	899	18054	33	
2006		2255	10202	670	643	228	14226	7088		17054		442	13273	13509	197	31	234	1381	16938	177	
2007		2746	5583	551	354	45	12984	14214		9974		150	4371	29683	133	187	856	3030	20884	382	
2008		2828	4848	1659	22	27	17125	7697		14201		10	1495	23796	1298	2969	68	3215	19622	48	

Table 1. Continued

SHRIMPERS

SFA	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8
NAFO	4Tp	4Tq	4To	4Tn	4Tk	4Tq	4Sz	4Si	4Sy	4Ss	4Tf	4Tk	4Ss	4Sx	4Sy	4Sv	4Sv	4Ra	4Rb	4Rc	4R
2009		3459	4949	1238	708		18604	11773		12688		23	772	26112	1068	293	153	1840	19359	5	
2010		3513	5641	973	130	162	18759	12138	16	17407			76	29089	2358	1835	14	586	18904	68	
2011		4406	6072	1554	3116	182	13996	11308		16476		82	946	24793	3271	1210	85	1498	15209		
2012		4240	6233	2515	1765	155	13183	7712		12668	18		418	24983	1303	2171	290	1264	16636	121	

WEIGHTING FACTOR

SFA	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8
NAFO	4Tp	4Tq	4To	4Tn	4Tk	4Tq	4Sz	4Si	4Sy	4Ss	4Tf	4Tk	4Ss	4Sx	4Sy	4Sv	4Sv	4Ra	4Rb	4Rc	4R
2000	178.38		15.45			22.11		17.97		10.69	12.21		15.60	39.28					29.57		
2001	48.15		23.73			22.50		18.46		22.22	82.80		15.37	25.74					29.34		
2002	50.91		13.66			8.70		50.50		42.81	5.88		16.82	23.06					26.54		
2003	163.53		14.36			11.80		19.96		14.77	79.10		22.24	25.83					19.37		
2004	90.45		24.38			20.76		8.14		14.02	29.34		24.20	23.82					36.27		
2005	25.67		14.29			11.05		21.18		21.72	1.72		22.73	20.15					44.65		
2006	39.43		12.21			15.04		14.25		27.41	28.96		16.22	30.55					26.06		
2007	19.89		11.03			18.22		20.28		34.19	10.03		13.72	20.12					28.01		
2008	18.46		15.41			17.03		16.87		28.35	3.50		19.91	17.36					34.80		
2009	19.16		11.72			25.16		21.77		28.91	1.28		23.40	11.94					68.47		
2010	20.47		18.20			15.03		15.10		27.97			11.77	16.23					24.24		
2011	7.83		37.42			23.34		19.08		28.51			9.56	13.46					24.51		
2012	15.92		11.04			19.03		38.34		23.58	0.41		13.71	20.50					17.07		

Table 2. Occurrence, catch estimated after the correction for the 1 kg catches and percentage of the catch that was kept, for the 69 taxa recorded by the observers in 2012.

	Occurrence		Catch	Kept
	n stations	%	kg	%
Northern shrimp	1188	99.832	30852128	99.9
Capelin	1071	90.000	149272	0.0
Greenland halibut	978	82.185	50902	3.1
Atlantic herring	911	76.555	64341	0.5
American plaice	884	74.286	51145	0.0
Redfishes	818	68.739	14905	0.1
White barracudina	752	63.193	16892	0.1
Witch flounder	603	50.672	15312	0.0
Thorny skate	517	43.445	10114	0.0
Atlantic cod	381	32.017	22888	0.1
Atlantic hagfish	373	31.345	3010	0.0
Eelpouts	340	28.571	9229	0.0
4-beard rockling	260	21.849	1444	0.0
Blennies	242	20.336	3507	0.0
White shrimp	201	16.891	2842	7.4
Marlin-spike	132	11.092	643	0.0
Poachers	123	10.336	123	0.0
Winter flounder	86	7.227	2132	0.0
Squids	79	6.639	404	0.0
Atlantic soft pout	72	6.050	106	0.0
Octopuses	71	5.966	992	0.0
Arctic cod	66	5.546	1608	0.0
Anemones	60	5.042	198	0.0
Atlantic halibut	57	4.790	12582	75.8
Smooth skate	51	4.286	229	0.0
White hake	45	3.782	259	0.0
4-line blenny	45	3.782	1657	0.0
Silver hake	42	3.529	162	0.0
Snailfishes	41	3.445	742	0.0
Snow crab	40	3.361	100	0.0
Jellyfishes	39	3.277	230	0.0
Wrymouth	37	3.109	71	0.0
Sculpins (*Myoxocephalus*)	32	2.689	672	0.0
Sand lances	32	2.689	1007	0.0
Bobtails	32	2.689	681	0.0

Table 2. Continued

	Occurrence		Catch	Kept
	n stations	%	kg	%
Hookears	31	2.605	67	0.0
Sea stars	25	2.101	173	0.0
Hatchet fishes	24	2.017	392	0.0
Lumpsuckers	21	1.765	113	0.0
Atlantic wolffish	17	1.429	281	0.0
Light fishes	13	1.092	184	0.0
Lumpfish	13	1.092	24	0.0
Sponges	13	1.092	247	0.0
Sculpins (*Triglops*)	12	1.008	249	0.0
Other shrimps	12	1.008	194	0.0
Sea pens	12	1.008	199	0.0
Rocklings	9	0.756	73	0.0
Sticklebacks	8	0.672	120	0.0
Black dogfish	7	0.588	25414	99.4
Slender snipe eel	6	0.504	134	0.0
Bivalves	6	0.504	114	0.0
Urchins	5	0.420	120	0.0
Yellow tail flounder	4	0.336	52	0.0
Greenland cod	3	0.252	34	0.0
Spiny tail skate	3	0.252	22	0.0
Ocean pout	3	0.252	9	0.0
Spotted wolffish	2	0.168	51	0.0
Longfin hake	2	0.168	27	0.0
Monkfish	2	0.168	116	0.0
Striped shrimp	2	0.168	47	0.0
Crabs *Hyas*	2	0.168	22	0.0
Brittle stars	2	0.168	41	0.0
American shad	1	0.084	24	0.0
Rainbow smelt	1	0.084	11	0.0
Winter skate	1	0.084	2	0.0
Sea lamprey	1	0.084	24	0.0
Dragonfishes	1	0.084	19	0.0
Lightfishes	1	0.084	11	0.0
King crab	1	0.084	38	0.0

Table 3a. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2012.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2012
Capelan	Capelin	*Mallotus villosus*	499	20279	34380	8724	34657	10	90	26898	23735	149272
Hareng atlantique	Atlantic herring	*Clupea harengus*	1557	1820	8644	651	4606	5	9	36382	10667	64341
Plie canadienne	American plaice	*Hippoglossoides platessoides*	797	1582	9417	277	31833	3	21	3516	3700	51145
Flétan du Groenland	Greenland halibut	*Reinhardtius hippoglossoides*	3093	10610	6839	2303	1397	2	66	16341	10251	50902
Aiguillat noir	Black dogfish	*Centroscyllium fabricii*		10		54	11			25338		25414
Morue franche	Atlantic cod	*Gadus morhua*	1263	66	3639	53	12309		13	5146	400	22888
Lussion blanc	White barracudina	*Arctozenus risso*	98	1325	1345	2398	3090	0	26	6595	2014	16892
Plie grise	Witch flounder	*Glyptocephalus cynoglossus*	65	3011	684	450	1974	3	28	6581	2515	15312
Sébastes	Redfishes	*Sebastes sp*	63	698	923	644	4886	1	171	2644	4875	14905
Flétan Atlantique	Atlantic halibut	*Hippoglossus hippoglossus*	27	441	375		1627		41	6348	3722	12582
Raie épineuse	Thorny skate	*Amblyraja radiata*	755	623	2726	288	1607	1	6	846	3263	10114
Myxine du nord	Atlantic hagfish	*Myxine glutinosa*		1085	468	311	831	0	9	242	63	3010
Crevette blanche	White shrimp	*Pasiphaea multidentata*	11	919	152	186	106			1468		2842
Loup atlantique	Atlantic wolffish	*Anarhichas lupus*					271				10	281
Merluche blanche	White hake	*Urophycis tenuis*	45	51			67	0	10	37	49	259
Éponges	Sponges	*Porifera*		11	38		24			123	51	247
Raie lisse	Smooth skate	*Malacoraja senta*		58	8		137			26		229
Plumes de mer	Sea pens	*Pennatula borealis*		55						144		199
Merlu argenté	Silver hake	*Merluccius bilinearis*	3	21	12	8	49	0		51	18	162
Crabe des neiges	Snow crab	*Chionoecetes opilio*	10	9	47	7	9	0	1	17		100
Loup tacheté	Spotted wolffish	*Anarhichas minor*									51	51
Crevette ésope	Striped shrimp	*Pandalus montagui*					47					47
Merluche à longues nageoires	Longfin hake	*Phycis chesteri*	16	11								27
Lompe	Lumpfish	*Cyclopterus lumpus*	2	1	9		2			10		24
Raie tachetée	Winter skate	*Leucoraja ocellata*		2								2

Table 3b. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2011.

Shrimp fishing area			12	10	10	10	10	9	9	9	8	
NAFO unit area			4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2011
Capelan	Capelin	Mallotus villosus	1284	96943	10515	16674	47747		703	26509	12078	212455
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	8738	14719	14395	4451	6001		272	22573	12086	83235
Hareng atlantique	Atlantic herring	Clupea harengus	5110	3038	15138	2813	5941		1072	12939	20249	66299
Crevette ésope	Striped shrimp	Pandalus montagui	47							40516		40563
Plie canadienne	American plaice	Hippoglossoides platessoides	1272	6405	2146	694	10993		59	2804	1354	25728
Plie grise	Witch flounder	Glyptocephalus cynoglossus	191	3089	1772	1900	420		34	10971	1900	20277
Aiguillat noir	Black dogfish	Centroscyllium fabricii			11	18	18274				11	18314
Sébastes	Redfishes	Sebastes sp	292	512	1187	801	2186		339	2150	2602	10070
Morue franche	Atlantic cod	Gadus morhua	1311		2983		3802		63	495	297	8952
Lussion blanc	White barracudina	Arctozenus risso	48	423	521	1585	352		37	4974	528	8469
Raie épineuse	Thorny skate	Amblyraja radiata	1685	261	2927	262	1287		13	871	1012	8317
Crevette blanche	White shrimp	Pasiphaea multidentata		143	137	337	10			172	6758	7557
Myxine du nord	Atlantic hagfish	Myxine glutinosa	26	531	323	1112	1183		26	395	116	3712
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus			980					2651	16	3647
Raie lisse	Smooth skate	Malacoraja senta	7		15	37	67		4	69	1459	1658
Merlu argenté	Silver hake	Merluccius bilinearis	3	16	302	40	59		2	289	215	926
Raie tachetée	Winter skate	Leucoraja ocellata	709		15	12	6			17		759
Merluche blanche	White hake	Urophycis tenuis	41	40	17		51		20	110	218	497
Merluche à longues nageoires	Longfin hake	Phycis chesteri							86	27	49	162
Loup atlantique	Atlantic wolffish	Anarhichas lupus					97			23	14	134
Loup tacheté	Spotted wolffish	Anarhichas minor					29			27	25	80
Crabe des neiges	Snow crab	Chionoecetes opilio	26	3	24	4				9	5	70
Éponges	Sponges	Porifera			23					40		64
Plumes de mer	Sea pens	Pennatula borealis									49	49

Table 3c. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2010.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2010
Capelan	Capelin	*Mallotus villosus*	2101	6463	15538	4855	34098		412	63368	29185	156020
Flétan du Groenland	Greenland halibut	*Reinhardtius hippoglossoides*	1917	4669	17393	7707	9812		25	18749	10563	70836
Crevette blanche	White shrimp	*Pasiphaea multidentata*		69	31	375	299			9554	30640	40968
Plie canadienne	American plaice	*Hippoglossoides platessoides*	12695	2156	12685	958	3524		71	3376	3759	39224
Hareng atlantique	Atlantic herring	*Clupea harengus*	1209	1200	6545	955	6012		165	11125	4484	31694
Raie épineuse	Thorny skate	*Amblyraja radiata*	8824	161	5796	604	1184			1117	1911	19597
Plie grise	Witch flounder	*Glyptocephalus cynoglossus*		625	2052	2075	2270			6323	5944	19288
Sébastes	Redfishes	*Sebastes sp*	281	193	2284	969	2210		10	2156	3447	11550
Lussion blanc	White barracudina	*Arctozenus risso*	8	657	1072	1574	2958		19	3206	1046	10540
Flétan Atlantique	Atlantic halibut	*Hippoglossus hippoglossus*	14		1664	1786	28			2110	1075	6676
Myxine du nord	Atlantic hagfish	*Myxine glutinosa*	21	301	701	892	847			564	221	3548
Morue franche	Atlantic cod	*Gadus morhua*	236	17	1173	28	606		53	647	346	3105
Merlu argenté	Silver hake	*Merluccius bilinearis*	4	99	143	103	275			471	217	1312
Merluche blanche	White hake	*Urophycis tenuis*	15	123	140	32	80			208	78	676
Raie lisse	Smooth skate	*Malacoraja senta*	61	63	26	32	24			149	120	475
Crabe des neiges	Snow crab	*Chionoecetes opilio*	8	3	66	6	105			3	7	197
Éponges	Sponges	*Porifera*			15		28				97	140
Crevette ésope	Striped shrimp	*Pandalus montagui*		18							73	91
Loup atlantique	Atlantic wolffish	*Anarhichas lupus*									69	69
Maquereau bleu	Atlantic mackerel	*Scomber scombrus*				8				50		58
Merluche à longues nageoires	Longfin hake	*Phycis chesteri*			45							45
Plumes de mer	Sea pens	*Pennatula borealis*		18						16		34
Lompe	Lumpfish	*Cyclopterus lumpus*	4		6	1				8	2	21
Loup à tête large	Northern wolffish	*Anarhichas denticulatus*		18								18
Loup tacheté	Spotted wolffish	*Anarhichas minor*								16		16
Aiguillat noir	Black dogfish	*Centroscyllium fabricii*								8		8

Table 3d. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2009.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2009
Capelan	Capelin	Mallotus villosus	2515	4183	40320	4531	10971	2	1287	16266	241619	321693
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	3324	4965	19189	8162	4804	6	276	19102	4779	64608
Hareng atlantique	Atlantic herring	Clupea harengus	4958	2106	19093	1314	2487	3	158	12192	14406	56717
Crevette blanche	White shrimp	Pasiphaea multidentata			122	158	90			21629		22000
Lussion blanc	White barracudina	Arctozenus risso	37	383	1355	1528	1387	6	86	11182	1669	17633
Plie canadienne	American plaice	Hippoglossoides platessoides	2408	797	2235	281	2822		12	2294	6642	17492
Plie grise	Witch flounder	Glyptocephalus cynoglossus	39	1160	1655	952	1635	1	24	8040	3546	17053
Crevette ésope	Striped shrimp	Pandalus montagui	19							16889		16908
Morue franche	Atlantic cod	Gadus morhua	4083	72	4238	50	1718		32	504	705	11402
Sébastes	Redfishes	Sebastes sp	338	517	1413	823	1022	2	215	2304	3121	9755
Raie épineuse	Thorny skate	Amblyraja radiata	349	73	1857	221	545	1		1778	182	5005
Myxine du nord	Atlantic hagfish	Myxine glutinosa	97	241	1747	849	797	0	8	258	69	4067
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus	6		1015		39			788	571	2418
Merluche blanche	White hake	Urophycis tenuis	14	38	134	163	41		8	507	24	929
Plumes de mer	Sea pens	Pennatula borealis		12		327	231					570
Raie lisse	Smooth skate	Malacoraja senta		13	32	23				328	15	411
Merluche à longues nageoires	Longfin hake	Phycis chesteri		23		44	231			24	68	391
Maquereau bleu	Atlantic mackerel	Scomber scombrus		6	228			3				236
Merlu argenté	Silver hake	Merluccius bilinearis		7	37	27	30			71		172
Crabe des neiges	Snow crab	Chionoecetes opilio	39	27	46	4	8			5		129
Raie tachetée	Winter skate	Leucoraja ocellata								3	72	75
Loup atlantique	Atlantic wolffish	Anarhichas lupus									39	39
Éponges	Sponges	Porifera					29					29
Lompe	Lumpfish	Cyclopterus lumpus	2	1	2		3			14		22
Aiguillat noir	Black dogfish	Centroscyllium fabricii				10						10

Table 3e. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2008.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2008
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	8680	13063	36590	24189	5440	7	510	26313	6517	121310
Capelan	Capelin	Mallotus villosus	917	6578	9761	1230	13997	2	210	30450	29523	92669
Morue franche	Atlantic cod	Gadus morhua	12620		16451	8	8281	2		541	7249	45151
Sébastes	Redfishes	Sebastes sp	366	727	1992	2158	2544	2	820	5891	11521	26021
Hareng atlantique	Atlantic herring	Clupea harengus	976	3433	2781	1693	3426	2	162	4874	7737	25084
Plie canadienne	American plaice	Hippoglossoides platessoides	1214	1426	2842	2218	8661	2	101	1891	4750	23105
Lussion blanc	White barracudina	Arctozenus risso	7	1746	697	563	2470		54	13525	918	19982
Plie grise	Witch flounder	Glyptocephalus cynoglossus	85	2357	1433	1162	941	2	71	10022	3095	19168
Raie épineuse	Thorny skate	Amblyraja radiata	1782	1228	3015	923	1098		53	1176	2742	12018
Myxine du nord	Atlantic hagfish	Myxine glutinosa	191	250	854	544	498		54	340	24	2754
Crevette blanche	White shrimp	Pasiphaea multidentata		986	100	253				456		1796
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus	6	5	11		737			590	360	1710
Merluche blanche	White hake	Urophycis tenuis		138	61	54	402	1		241	198	1096
Maquereau bleu	Atlantic mackerel	Scomber scombrus				95	873			9		978
Raie lisse	Smooth skate	Malacoraja senta		134	71	115	37			286		642
Merlu argenté	Silver hake	Merluccius bilinearis		87	106	14	112			221	7	547
Merluche à longues nageoires	Longfin hake	Phycis chesteri			34	169	28			122		353
Crabe des neiges	Snow crab	Chionoecetes opilio	10	6	25	9	10			8	247	316
Plumes de mer	Sea pens	Pennatula borealis		31		84			20			135
Lompe	Lumpfish	Cyclopterus lumpus		1	39		35			23		99
Crevette ésope	Striped shrimp	Pandalus montagui	18		51							70
Raie tachetée	Winter skate	Leucoraja ocellata			58							58
Loup atlantique	Atlantic wolffish	Anarhichas lupus					48			10		58
Aiguillat noir	Black dogfish	Centroscyllium fabricii			8	24				16		48
Éponges	Sponges	Porifera								35		35

Table 3f. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2007.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2007
Capelan	Capelin	Mallotus villosus	969	2064	9081	3162	28658	5	608	38255	4387	87189
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	3441	11045	11835	6903	6755	752	1234	3910€	5237	86307
Crevette blanche	White shrimp	Pasiphaea multidentata			6	98				152	56044	56301
Hareng atlantique	Atlantic herring	Clupea harengus	533	1161	6430	978	2078		1365	4658	6592	23796
Sébastes	Redfishes	Sebastes sp	307	981	818	645	2306	421	11243	3057	3792	23571
Plie canadienne	American plaice	Hippoglossoides platessoides	349	888	2567	199	8184	110	127	1595	5097	19117
Plie grise	Witch flounder	Glyptocephalus cynoglossus	325	2103	620	1779	794	150	98	5945	1427	13240
Raie épineuse	Thorny skate	Amblyraja radiata		672	781	763	2225	24	258	1555	1472	7751
Morue franche	Atlantic cod	Gadus morhua	156	174	678		696		6	161	3012	4883
Lussion blanc	White barracudina	Arctozenus risso	39	490	448	1220	239		107	1166	261	3969
Myxine du nord	Atlantic hagfish	Myxine glutinosa	215	357	387	850	242	3	120	571	47	2792
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		81	346	1352	68	261	5	80		2194
Merluche blanche	White hake	Urophycis tenuis		122	394	58	210	70	452	403	70	1778
Merlu argenté	Silver hake	Merluccius bilinearis		82	61	8	28		298	411		889
Loup atlantique	Atlantic wolffish	Anarhichas lupus			212		252					464
Merluche à longues nageoires	Longfin hake	Phycis chesteri		11	109	61			27	121		329
Crevette ésope	Striped shrimp	Pandalus montagui							220			220
Raie lisse	Smooth skate	Malacoraja senta		43	31	52	22		3	61		213
Loup à tête large	Northern wolffish	Anarhichas denticulatus					171					171
Loup tacheté	Spotted wolffish	Anarhichas minor					103			20		123
Crabe des neiges	Snow crab	Chionoecetes opilio	2	45	5	2	9		4	4	8	79
Lompe	Lumpfish	Cyclopterus lumpus		3	16	6			9	10		43
Maquereau bleu	Atlantic mackerel	Scomber scombrus		23	9					10		42
Aiguillat noir	Black dogfish	Centroscyllium fabricii								28		28

Table 3g. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2006.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2006
Capelan	Capelin	Mallotus villosus	160	5086	19975	5329	17334	29	3461	28797	14106	94278
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	1266	13507	18938	8589	15544	78	6400	9681	8072	82075
Sébastes	Redfishes	Sebastes sp	104	1064	1149	546	2338	26	25612	9648	5336	45823
Hareng atlantique	Atlantic herring	Clupea harengus	267	1846	11312	884	5997		5191	476	5939	31910
Plie canadienne	American plaice	Hippoglossoides platessoides	773	5523	4858	869	3217		937	2815	1722	20715
Plie grise	Witch flounder	Glyptocephalus cynoglossus		1788	1252	1207	1888		281	1537	1358	9311
Raie épineuse	Thorny skate	Amblyraja radiata	871	1307	2318	402	339		303	1496	543	7580
Lussion blanc	White barracudina	Arctozenus risso		338	638	149	850		339	3583	192	6089
Morue franche	Atlantic cod	Gadus morhua	218	96	2909	42	724		37	28	380	4434
Myxine du nord	Atlantic hagfish	Myxine glutinosa	238	1031	479	345	579		99	316	35	3122
Merluche blanche	White hake	Urophycis tenuis		124	253	25	39		46	633	9	1130
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		142	70		658				52	923
Crevette ésope	Striped shrimp	Pandalus montagui			812							812
Crevette blanche	White shrimp	Pasiphaea multidentata		227					11	133		371
Merlu argenté	Silver hake	Merluccius bilinearis		36						283	22	340
Raie lisse	Smooth skate	Malacoraja senta		131	103						11	246
Merluche à longues nageoires	Longfin hake	Phycis chesteri				71	27		65			164
Crabe des neiges	Snow crab	Chionoecetes opilio		92	6	1	3		1		17	120
Loup atlantique	Atlantic wolffish	Anarhichas lupus		52								52
Raie tachetée	Winter skate	Leucoraja ocellata			41							41
Lompe	Lumpfish	Cyclopterus lumpus		24	10				3			38
Éponges	Sponges	Porifera		37								37
Loup tacheté	Spotted wolffish	Anarhichas minor		24								24
Aiguillat noir	Black dogfish	Centroscyllium fabricii			7	13						20
Maquereau bleu	Atlantic mackerel	Scomber scombrus			8							8

Table 3h. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2005.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2005
Capelan	Capelin	Mallotus villosus	2709	1097	8547	15586	53059	171	8451	3590	125892	219101
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	1209	2430	19407	488	4607	186	5678	2820	27357	64183
Hareng atlantique	Atlantic herring	Clupea harengus	6180	244	8599	1147	7311	103	10319	1966	13611	49478
Sébastes	Redfishes	Sebastes sp	299	76	1154	333	2097	25	16883	316	3069	24252
Plie canadienne	American plaice	Hippoglossoides platessoides	1042	3032	3428	305	8238	148	1714	333	1447	19687
Raie épineuse	Thorny skate	Amblyraja radiata	607	6	1551	28	2537		814	36	20	5599
Crevette ésope	Striped shrimp	Pandalus montagui				2922						2922
Morue franche	Atlantic cod	Gadus morhua	118	7	651	175	1525		122	9	21	2629
Plie grise	Witch flounder	Glyptocephalus cynoglossus	66	514	460	32	652	43	436	346		2548
Lussion blanc	White barracudina	Arctozenus risso		28	399	25	695		53	112	129	1441
Myxine du nord	Atlantic hagfish	Myxine glutinosa	26	169	261	64	615	7	268	14		1424
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus	9	486	41		29			443		1007
Crevette blanche	White shrimp	Pasiphaea multidentata							682			682
Loup tacheté	Spotted wolffish	Anarhichas minor			331		22					353
Crabe des neiges	Snow crab	Chionoecetes opilio	2	1	3		24		151	4		185
Merluche blanche	White hake	Urophycis tenuis		20	20		15	89	32			177
Raie lisse	Smooth skate	Malacoraja senta			38		5		54			96
Maquereau bleu	Atlantic mackerel	Scomber scombrus			55							55
Loup à tête large	Northern wolffish	Anarhichas denticulatus									45	45
Merlu argenté	Silver hake	Merluccius bilinearis			5		23		14			41
Lompe	Lumpfish	Cyclopterus lumpus	2		5		4		9			21
Loup atlantique	Atlantic wolffish	Anarhichas lupus					12					12

Table 3i. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2004.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2004
Capelan	Capelin	Mallotus villosus	322	2199	12121	1247	137677	221	9728	2541	144613	310669
Hareng atlantique	Atlantic herring	Clupea harengus	1357	10369	5152	422	19086	499	5309	24743	9387	76323
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	445	6140	14325	1328	8280	452	6072	20813	2823	60678
Plie canadienne	American plaice	Hippoglossoides platessoides	1138	6500	2311	134	29449	30	1348	973	1109	42992
Sébastes	Redfishes	Sebastes sp	120	1394	1501	331	2806	39	4380	1365	2369	14305
Lussion blanc	White barracudina	Arctozenus risso		322	363	119	7394		1591	2780	352	12921
Raie épineuse	Thorny skate	Amblyraja radiata	421	1478	2452	52	4523		967	680	497	11070
Plie grise	Witch flounder	Glyptocephalus cynoglossus		3103	1285	83	1287	89	753	3576	463	10638
Morue franche	Atlantic cod	Gadus morhua	264	1177	580		5307		208	333	67	7935
Crevette blanche	White shrimp	Pasiphaea multidentata		34			5901			1090		7025
Myxine du nord	Atlantic hagfish	Myxine glutinosa		617	749	66	298		512	298		2540
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		65	914		309			834		2121
Merluche blanche	White hake	Urophycis tenuis		182	89	17	50	21	52	166	52	629
Crabe des neiges	Snow crab	Chionoecetes opilio	181	13	6		19		7	2	7	235
Raie lisse	Smooth skate	Malacoraja senta		5	45	2	107		10	26		195
Loup atlantique	Atlantic wolffish	Anarhichas lupus					148					148
Merluche à longues nageoires	Longfin hake	Phycis chesteri			83				24			107
Merlu argenté	Silver hake	Merluccius bilinearis		15	9		6		58	10		98
Raie tachetée	Winter skate	Leucoraja ocellata					66					66
Éponges	Sponges	Porifera		24			28					52
Loup tacheté	Spotted wolffish	Anarhichas minor								48		48
Lompe	Lumpfish	Cyclopterus lumpus			10				2			12
Aiguillat noir	Black dogfish	Centroscyllium fabricii			10							10

Table 3j. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2003.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2003
Capelan	Capelin	Mallotus villosus	166	10283	19134	1392	65348	40	6044	1764	31843	136014
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	6378	15943	14794	7315	12314	237	13288	11476	12661	94405
Hareng atlantique	Atlantic herring	Clupea harengus	440	3205	7097	552	12243		6887	1653	8327	40403
Sébastes	Redfishes	Sebastes sp	726	943	979	2212	5051	35	16912	3180	8866	38904
Plie canadienne	American plaice	Hippoglossoides platessoides	739	3327	2448	586	7193		1708	580	1920	18501
Plie grise	Witch flounder	Glyptocephalus cynoglossus	167	2906	538	1084	1938	40	1916	993	6272	15855
Crevette blanche	White shrimp	Pasiphaea multidentata		100	4		3127			568	9402	13201
Morue franche	Atlantic cod	Gadus morhua	75	485	470	120	7249		1317	206	214	10137
Raie épineuse	Thorny skate	Amblyraja radiata	563	1304	1109	137	578		1067	91	420	5269
Lussion blanc	White barracudina	Arctozenus risso		157	65	295	2107		570	144	321	3658
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		316	106		561		1824		484	3292
Myxine du nord	Atlantic hagfish	Myxine glutinosa		776	120	222	318		481	131	52	2100
Merluche blanche	White hake	Urophycis tenuis		289	63	14	110		238	110	55	879
Raie lisse	Smooth skate	Malacoraja senta		304	3	17	6		126			455
Aiguillat noir	Black dogfish	Centroscyllium fabricii			142	68	7					216
Merlu argenté	Silver hake	Merluccius bilinearis		33	2	12	6		91		8	153
Merluche à longues nageoires	Longfin hake	Phycis chesteri				60	44					104
Lompe	Lumpfish	Cyclopterus lumpus			70	4			4	5	7	90
Loup tacheté	Spotted wolffish	Anarhichas minor							44	26		70
Loup atlantique	Atlantic wolffish	Anarhichas lupus					67					67
Crevette ésope	Striped shrimp	Pandalus montagui			47							47
Raie tachetée	Winter skate	Leucoraja ocellata		46								46
Crabe des neiges	Snow crab	Chionoecetes opilio		15	5		10		12			42
Éponges	Sponges	Porifera					30					30
Maquereau bleu	Atlantic mackerel	Scomber scombrus		15	6							21
Bar rayé	Striped bass	Morone saxatilis		14								14

Table 3k. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2002.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2002
Capelan	Capelin	Mallotus villosus	537	1888	12581	3472	56226	490	3968	25922	200852	305938
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	5773	7719	30359	10089	14628	1043	8081	14907	8159	100758
Sébastes	Redfishes	Sebastes sp	446	2585	1922	3339	5698	421	10505	8689	5186	38792
Hareng atlantique	Atlantic herring	Clupea harengus	211	479	3592	958	20688	24	2661	1526	5405	35545
Crevette blanche	White shrimp	Pasiphaea multidentata		2227	47		642	3491	7030	231	16608	30275
Plie canadienne	American plaice	Hippoglossoides platessoides	918	320	896	182	10295	938	960	640	2670	17818
Plie grise	Witch flounder	Glyptocephalus cynoglossus	485	455	1158	537	1225	744	908	448	1336	7297
Lussion blanc	White barracudina	Arctozenus risso		127	510	549	3070	2	682	1626		6566
Raie épineuse	Thorny skate	Amblyraja radiata	684	1151	1040	190	1140	89	506	965	293	6060
Morue franche	Atlantic cod	Gadus morhua	70		184	23	1530	3	1231	11	232	3285
Myxine du nord	Atlantic hagfish	Myxine glutinosa	34	124	197	1168	376	156	317	109		2481
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		196	3	101	214		600	139	1062	2314
Merluche blanche	White hake	Urophycis tenuis		24	9		30	15	42	8	95	223
Éponges	Sponges	Porifera					171		17			188
Merlu argenté	Silver hake	Merluccius bilinearis							165			165
Loup atlantique	Atlantic wolffish	Anarhichas lupus								92		92
Raie lisse	Smooth skate	Malacoraja senta		26	28				11	20		85
Aiguillat noir	Black dogfish	Centroscyllium fabricii		34	4	24		3				64
Merluche à longues nageoires	Longfin hake	Phycis chesteri						35				35
Loup tacheté	Spotted wolffish	Anarhichas minor							34			34
Crabe des neiges	Snow crab	Chionoecetes opilio					16					16
Lompe	Lumpfish	Cyclopterus lumpus		5	2				2			8

Table 3l. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2001.

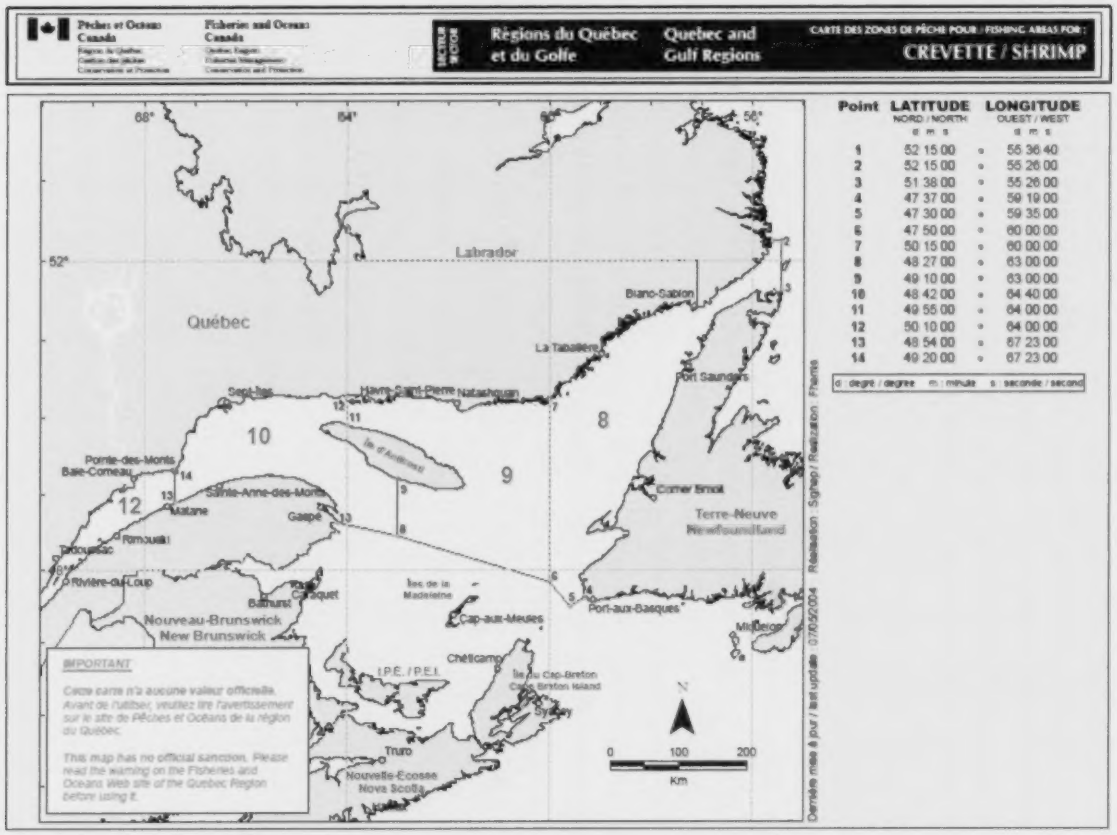
	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2001
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	825	17632	7394	10230	12855		4577	21587	11320	86420
Capelan	Capelin	Mallotus villosus	3614	3642	11407	2325	8225	42	2267	5716	40012	77251
Crevette blanche	White shrimp	Pasiphaea multidentata		736		157	285		154	407	38870	40607
Sébastes	Redfishes	Sebastes sp	266	2174	1322	1775	4267	166	5200	7672	15573	38416
Hareng atlantique	Atlantic herring	Clupea harengus	166	3846	2950	603	11684	248	2864	7944	6335	36641
Plie canadienne	American plaice	Hippoglossoides platessoides	50	1364	1140	218	6410	745	628	735	817	12107
Plie grise	Witch flounder	Glyptocephalus cynoglossus		3844	204	767	1938		296	1080	2119	10249
Morue franche	Atlantic cod	Gadus morhua		11	145	51	4896		294	356	3906	9659
Raie épineuse	Thorny skate	Amblyraja radiata	812	1573	170	306	1846		228	296	311	5542
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus				689			804		1613	3107
Myxine du nord	Atlantic hagfish	Myxine glutinosa	33	1209	152	797	596		47	87	89	3009
Lussion blanc	White barracudina	Arctozenus risso		370	87	199	270		162	412	484	1985
Raie lisse	Smooth skate	Malacoraja senta			50		992		3	107		1152
Merlu argenté	Silver hake	Merluccius bilinearis		81		15	58		357	5	6	524
Aiguillat noir	Black dogfish	Centroscyllium fabricii		177		35	42			24		277
Merluche blanche	White hake	Urophycis tenuis		17		39	16		82	28	21	203
Merluche à longues nageoires	Longfin hake	Phycis chesteri		47		37	44		15	51		196
Loup tacheté	Spotted wolffish	Anarhichas minor							46		29	75
Loup atlantique	Atlantic wolffish	Anarhichas lupus			38					29		67
Crabe des neiges	Snow crab	Chionoecetes opilio	13	4		3	2		4		3	30
Lompe	Lumpfish	Cyclopterus lumpus					2					2

Table 3m. Bycatch (kg) by taxum and by combination of NAFO unit areas and shrimp fishing areas, in 2000.

	Shrimp fishing area		12	10	10	10	10	9	9	9	8	
	NAFO unit area		4Tp 4Tq	4To 4Tn 4Tk	4Tq 4Sz	4Si 4Sy	4Ss	4Tf 4Tk	4Ss	4Sx 4Sy 4Sv	4Sv 4Ra 4Rb 4Rc 4R	Total 2000
Flétan du Groenland	Greenland halibut	Reinhardtius hippoglossoides	2497	18804	21457	6571	10100	1326	12288	37855	10294	121193
Capelan	Capelin	Mallotus villosus	1518	5189	31798	3461	28213	1784	10827	12487	25586	120863
Hareng atlantique	Atlantic herring	Clupea harengus	480	9236	18784	977	14104	101	9879	15432	6520	75512
Sébastes	Redfishes	Sebastes sp		2012	688	1426	3750	363	8537	15869	11505	44150
Plie grise	Witch flounder	Glyptocephalus cynoglossus		2404	347	200	659	773	3003	6137	18364	31888
Crevette blanche	White shrimp	Pasiphaea multidentata		1616	10943	1312	515	941	3603			18930
Plie canadienne	American plaice	Hippoglossoides platessoides	541	1093	1428	563	2159	94	486	3269	1414	11046
Raie épineuse	Thorny skate	Amblyraja radiata	1249	1216	1478	16	1696	76	664	774	468	7637
Crevette ésope	Striped shrimp	Pandalus montagui	7314									7314
Morue franche	Atlantic cod	Gadus morhua		21	666		1112	6	150	1691	952	4597
Myxine du nord	Atlantic hagfish	Myxine glutinosa		1490	142	291	352	128	702	880	120	4104
Flétan Atlantique	Atlantic halibut	Hippoglossus hippoglossus		355	413	90	175	33	400	353	1478	3298
Lussion blanc	White barracudina	Arctozenus risso		123	52	67	84	333	66			725
Merluche blanche	White hake	Urophycis tenuis		296			4	57	89	28	105	579
Loup atlantique	Atlantic wolffish	Anarhichas lupus		243			67		9			319
Lompe	Lumpfish	Cyclopterus lumpus			290		2		1			293
Merlu argenté	Silver hake	Merluccius bilinearis		26			2	5	39	49	6	127
Raie lisse	Smooth skate	Malacoraja senta		17	10				69			95
Crabe des neiges	Snow crab	Chionoecetes opilio		7	71	2	2		6		5	93
Loup tacheté	Spotted wolffish	Anarhichas minor		31					16	39		86
Maquereau bleu	Atlantic mackerel	Scomber scombrus		48			27	6				81
Éponges	Sponges	Porifera					32			39		71
Aiguillat noir	Black dogfish	Centroscyllium fabricii				36	5					41
Merluche à longues nageoires	Longfin hake	Phycis chesteri		15		18						33
Raie tachetée	Winter skate	Leucoraja ocellata			5							5

Table 4. Bycatch in number for Greenland halibut, redfishes, American plaice, witch flounder and Atlantic cod, for the entire Estuary and Gulf shrimp fishery from 2000 to 2012.

	Greenland Halibut	Redfishes	American plaice	Witch flounder	Atlantic cod
2000	2250709	1229860	160265	385284	90605
2001	823940	880143	266553	231359	84610
2002	1535489	427137	501286	129261	13969
2003	1128626	910484	576746	522489	90132
2004	631050	234745	1205897	156242	63879
2005	1212824	1235291	306423	29939	32857
2006	1136530	1692394	224655	129888	95847
2007	1355308	515954	173071	99566	33811
2008	2140954	429619	218105	606976	462645
2009	825409	139630	244035	300540	160092
2010	846133	219238	808034	158218	44567
2011	2327035	123194	359438	177792	122797
2012	518156	399249	1033704	328108	429716


Pêches et Océans Canada
Fisheries and Oceans Canada
Régions du Québec et du Golfe
Quebec and Gulf Regions
CARTE DES ZONES DE PÊCHE POUR / FISHING AREAS FOR :
CREVETTE / SHRIMP
Point LATITUDE NORD / NORTH LONGITUDE OUEST / WEST
1 52 15 00 55 36 40
2 52 15 00 55 26 00
3 51 38 00 55 26 00
4 47 37 00 59 19 00
5 47 30 00 59 35 00
6 47 50 00 60 00 00
7 50 15 00 60 00 00
8 48 27 00 63 00 00
9 49 10 00 63 00 00
10 48 42 00 64 40 00
11 49 55 00 64 00 00
12 50 10 00 64 00 00
13 48 54 00 67 23 00
14 49 20 00 67 23 00
d : degré / degree m : minute s : seconde / second
Labrador
Québec
Blanc-Sablon
La Tabatière
Port Saunders
Saint-Jean
Havre-Saint-Pierre
Natashquan
Pointe-des-Monts
Baie-Comeau
Sainte-Anne-des-Monts
Matane
Gaspé
Rimouski
Rivière-du-Loup
Bathurst
Caraquet
Nouveau-Brunswick
New Brunswick
Îles de la Madeleine
Cap-aux-Meules
Port-aux-Basques
Terre-Neuve
Newfoundland
Miquelon
Chéticamp
I.P.E. / P.E.I.
Île du Cap-Breton
Cape Breton Island
Sydney
Truro
Nouvelle-Écosse
Nova Scotia
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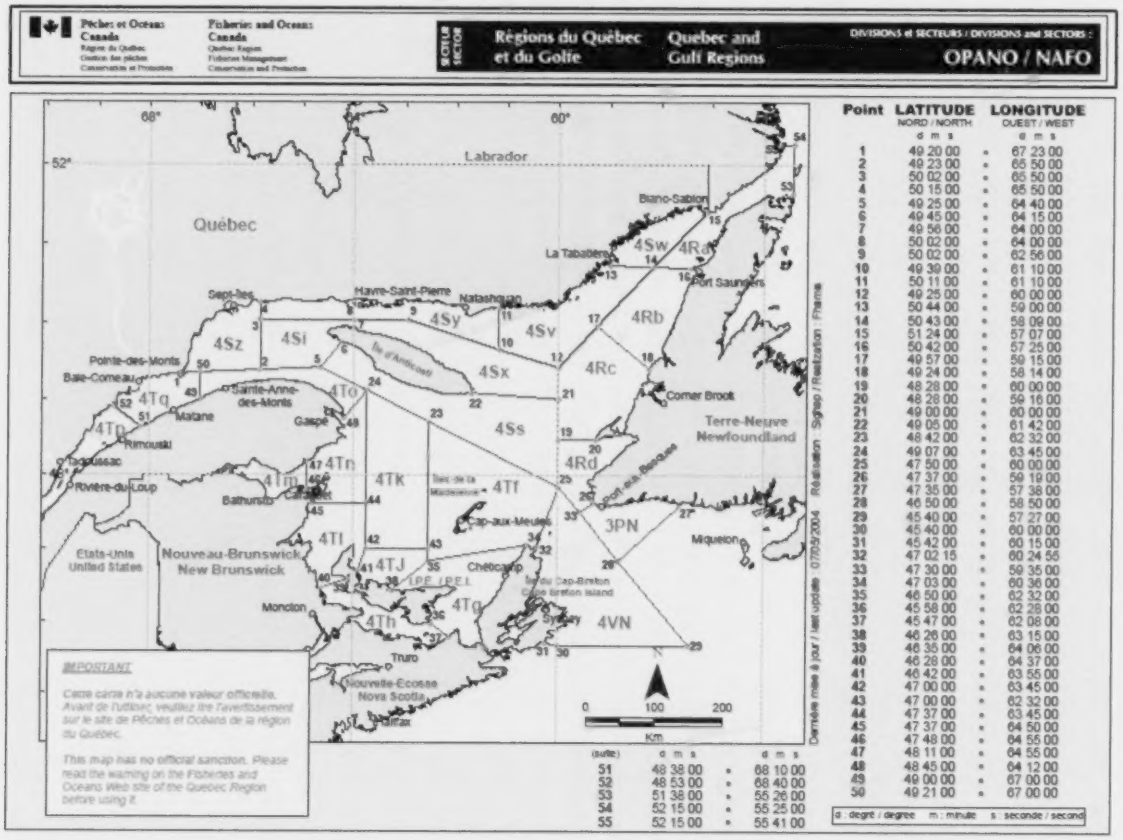
This map has no official sanction. Please read the warning on the Fisheries and Oceans Web site of the Quebec Region before using it.
0 100 200
Km
Dernière mise à jour / last update: 07/05/2004 Réalisation : Sig/rep / Realization : Fhamil

Figure 1. Shrimp fishing areas in the Estuary and Gulf of St. Lawrence.



Point	LATITUDE NORD / NORTH d m s		LONGITUDE OUEST / WEST d m s
1	49 20 00	-	67 23 00
2	49 23 00	-	65 50 00
3	50 02 00	-	65 50 00
4	50 15 00	-	65 50 00
5	49 25 00	-	64 40 00
6	49 45 00	-	64 15 00
7	49 56 00	-	64 00 00
8	50 02 00	-	64 00 00
9	50 02 00	-	62 56 00
10	49 39 00	-	61 10 00
11	50 11 00	-	61 10 00
12	49 25 00	-	60 00 00
13	50 44 00	-	59 00 00
14	50 43 00	-	58 09 00
15	51 24 00	-	57 07 00
16	50 42 00	-	57 25 00
17	49 57 00	-	59 15 00
18	49 24 00	-	58 14 00
19	48 28 00	-	60 00 00
20	48 28 00	-	59 16 00
21	49 00 00	-	60 00 00
22	49 05 00	-	61 42 00
23	48 42 00	-	62 32 00
24	49 07 00	-	63 45 00
25	47 50 00	-	60 00 00
26	47 37 00	-	59 19 00
27	47 35 00	-	57 38 00
28	46 50 00	-	58 50 00
29	45 40 00	-	57 27 00
30	45 40 00	-	60 00 00
31	45 42 00	-	60 15 00
32	47 02 15	-	60 24 55
33	47 30 00	-	59 35 00
34	47 03 00	-	60 36 00
35	46 50 00	-	62 32 00
36	45 58 00	-	62 28 00
37	45 47 00	-	62 08 00
38	46 26 00	-	63 15 00
39	46 35 00	-	64 06 00
40	46 28 00	-	64 37 00
41	46 42 00	-	63 55 00
42	47 00 00	-	63 45 00
43	47 00 00	-	62 32 00
44	47 37 00	-	63 45 00
45	47 37 00	-	64 50 00
46	47 48 00	-	64 55 00
47	48 11 00	-	64 55 00
48	48 45 00	-	64 12 00
49	49 00 00	-	67 00 00
50	49 21 00	-	67 00 00

(suite)	d m s		d m s
51	48 38 00	-	68 10 00
52	48 53 00	-	68 40 00
53	51 38 00	-	55 26 00
54	52 15 00	-	55 25 00
55	52 15 00	-	55 41 00

d : degré / degree m : minute s : seconde / second

Figure 2. NAFO unit areas in the Gulf of St. Lawrence.

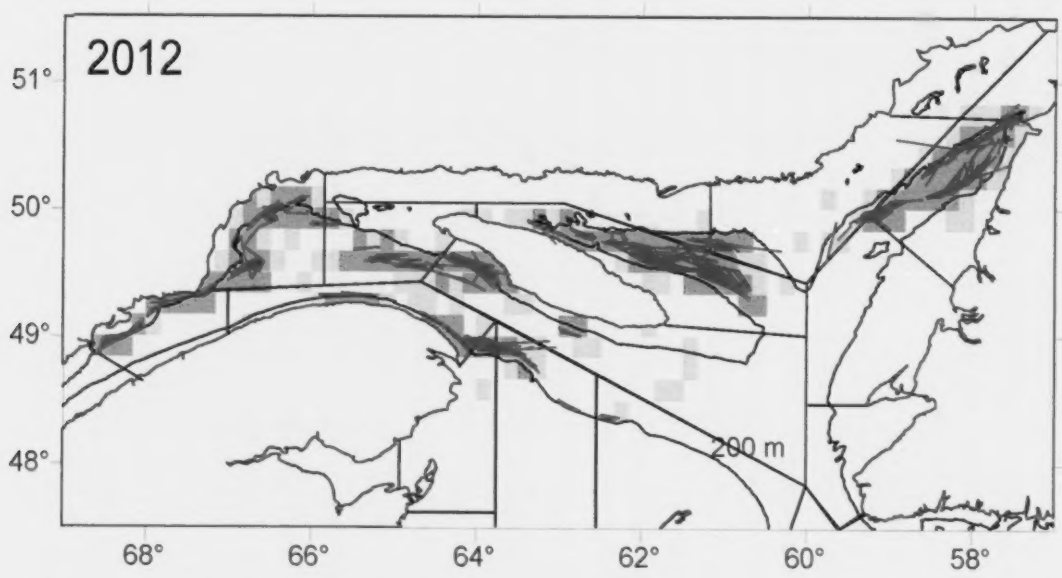


Figure 3. Geographic distribution of annual fishing effort by statistical square (gray squares: pale<100h, dark>100h) and of fishing tows (blue lines) realised with an observer on board in 2012. The NAFO unit areas are also shown.

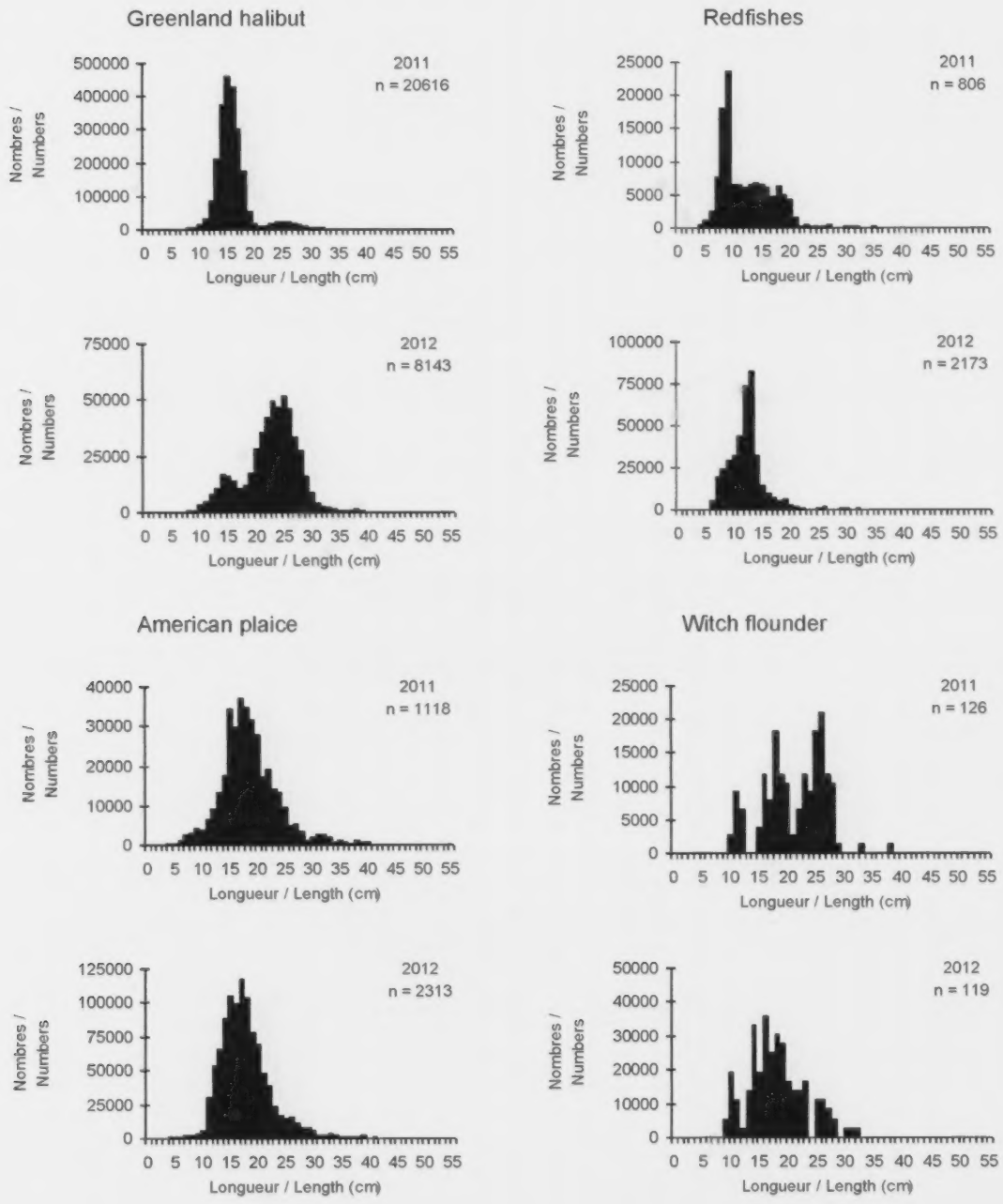


Figure 4. Bycatch length frequency distribution by taxa, in 2011 and 2012. The number (n) of specimens that were measured is shown.

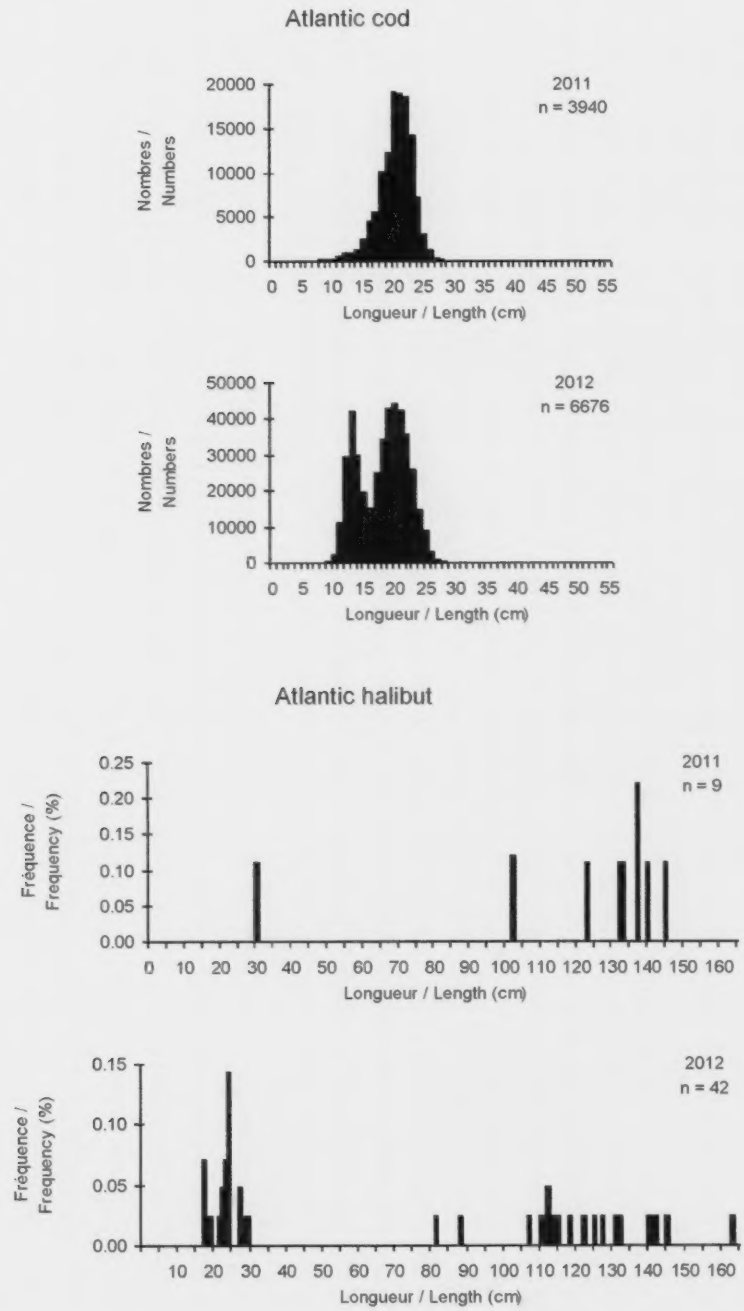


Figure 4 Continued.